

Environmental Attitudes and Sustainability Practices: Evaluating the Impact of the Course 'People and the Earth's Ecosystem' on Students

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ABSTRACT

This research focused on students' attitudes toward environmental concern, ecological awareness, environmental governance, and personal environmental responsibility, as well as their sustainability practices related to waste management, energy, and water conservation, sustainable consumption, and environmental engagement. A descriptive research design was employed, involving students enrolled in the STS 11 course during the second semester of Academic Year 2024-2025. The findings revealed that students generally exhibited high levels of environmental attitudes and sustainability practices in both assessments, with noticeable improvements in the post-assessment results. Significant increases were observed in students' confidence in adopting sustainable practices, recognition of the impact of individual environmental actions, and participation in sustainability-related activities. The results further showed that the STS 11 course contributed positively to enhancing students' ecological awareness, environmental responsibility, and sustainability-oriented behavior through environmental discussions and experiential learning activities.

INTRODUCTION

Environmental degradation, climate change, biodiversity loss, pollution, and resource depletion have become major global concerns that threaten ecological balance, human health, and sustainable development. These environmental challenges have intensified the need for environmental education that promotes ecological awareness, sustainability consciousness, and environmentally responsible behavior among individuals, particularly students in higher education institutions. Education for Sustainable Development (ESD) emphasizes the role of education in equipping learners with the knowledge, values, skills, and attitudes necessary to address environmental problems and contribute to sustainable societies (UNESCO, 2024). Higher education institutions play a crucial role in cultivating environmental literacy and sustainability-oriented behaviors among students because universities serve as important venues for shaping civic responsibility, environmental ethics, and ecological awareness. Recent studies shown that environmental education positively influence students' environmental attitudes, sustainability practices, and pro-environmental behavior (Chen et al., 2025; Ardoin et al., 2023). Students who are exposed to sustainability-centered instruction are more likely to engage in conservation activities, support environmental policies, and adopt sustainable lifestyle practices such as waste reduction, energy conservation, and responsible consumption.

Environmental attitudes refer to individuals' beliefs, values, concern, and emotional responses toward environmental issues, while sustainability practices involve actual behaviors and actions that contribute to environmental protection and resource conservation. According to Zhang and Cao (2025), students with stronger ecological awareness are more likely to participate in environmental advocacy, support sustainability initiatives, and practice environmentally responsible behaviors in their daily lives.

In the Philippines, environmental education has been increasingly integrated into higher education curricula to strengthen sustainability awareness and environmental responsibility among students. One of the courses designed to address this objective is STS 11 – People and the Earth's Ecosystem, which explores the relationship between humans, science, technology, society, and the environment. The course aims to develop students' understanding of environmental issues, ecological systems, sustainability principles, and the role of human activities in environmental change. Through discussions, reflective activities, and sustainability-oriented instructional interventions. STS 11 seeks to enhance students' environmental literacy and encourage sustainable practices.

Despite the documented benefits of environmental education, previous studies also reveal persistent challenges in translating environmental awareness into consistent sustainable behavior. Although students frequently demonstrate high levels of environmental knowledge and positive attitudes toward environmental protection, these attributes do not always result in sustained behavioral change or active engagement in environmentally responsible practices (Lozano et al., 2023). This recurring finding suggests that knowledge and attitudes alone may be insufficient to influence long-term behavioral

commitment without appropriate instructional experiences and opportunities for practical application.

Moreover, existing research has predominantly examined environmental awareness or isolated dimensions of sustainability behavior, with relatively few studies simultaneously assessing changes in both environmental attitudes and sustainability practices following structures instructional interventions in higher education. Within the Philippine context, available studies have largely focused on measuring environmental awareness and have provided limited evidence regarding how specific sustainability-oriented instructional strategies influence students' environmental responsibility, behavioral commitment, and sustainability practices. In particular, there remains limited empirical evidence evaluating the effectiveness of STS 11 – People and the Earth's Ecosystem using a pre-assessment and post-assessment design to determine whether participation in the course leads to measurable improvements in students' environmental attitudes and sustainability practices.

Addressing this gap, the present study aimed to assess the environmental attitudes and sustainability practices of students enrolled in STS 11 – People and the Earth's Ecosystem. Specifically, it sought to: (1) determine the level of students' environmental attitudes before and after the instructional intervention; (2) determine the level of students' sustainability practices before and after the instructional intervention; and (3) evaluate changes in students' environmental attitudes and sustainability practices following exposure to sustainability-oriented instructional strategies implemented in the course. The study hypothesized that students would demonstrate significant improvements in both environmental attitudes and sustainability practices after completing the course. The findings are expected to contribute to the enhancement of sustainability education initiatives, curriculum development, and instructional strategies within higher education institutions.

THEORETICAL REVIEW

The conceptual framework of this study suggested a direct correlation between STS 11 – People and the Earth's Ecosystem course, environmental attitudes and sustainability practices among university students. This course influenced students by shaping their environmental attitudes, which in turn, guided their adoption of sustainable practices. It hypothesized that fostering positive environmental attitudes through environmental education will lead to more consistent and meaningful engagement in sustainability (Figure 1).

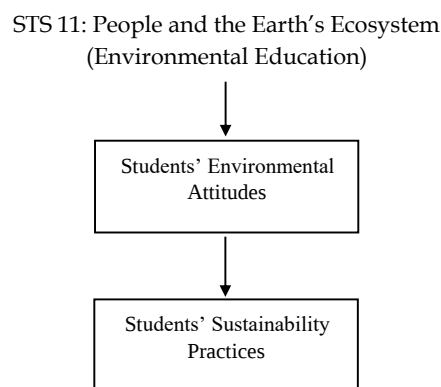


Figure 1. The conceptual framework of the study.

The framework is anchored on the Theory of Planned Behavior (Ajzen, 1991) and Environmental Education Theory. It posits that exposure to the STS 11 – People and the Earth's Ecosystem course enhances students' environmental attitudes through increased ecological awareness, environmental responsibility, and sustainability knowledge. Positive environmental attitudes subsequently influence students' adoption of sustainability practices, including waste reduction, resource conservation, sustainable consumption, and environmental engagement. Thus, environmental attitudes serve as a mediating mechanism through which environmental education promotes sustainable behavior.

METHODOLOGY

This study employed a descriptive-correlational research design. This design enabled the researcher to describe the levels of environmental attitudes and sustainability practices among students and determine the relationship between these variables without manipulating them. The sample size of 202 respondents was determined using Slovin's Formula with a 5% margin of error. Slovin's Formula is commonly applied in quantitative research to estimate an appropriate sample size when the total population is known (Antoro, 2024). The use of adequate sample sizes improves the reliability and representation of quantitative findings (Sadiq et al., 2024). The respondents were students enrolled in STS 11 – People and the Earth's Ecosystem during the second semester of Academic Year 2024-2025 at Davao Oriental State University. The respondents represented different academic programs and year levels. The study utilized validated survey questionnaire consisting of items measuring environmental attitudes and sustainability practices. The environmental attitudes section assessed students' ecological awareness, environmental responsibility, environmental governance support, and environmental knowledge. The sustainability practices section evaluated waste management practices, energy and water conservation, sustainable consumption, and environmental engagement. The instruments underwent expert validation and pilot testing to ensure reliability and validity. Cronbach's alpha coefficients indicated acceptable internal consistency for all scales. Permission to conduct the study was secured from the university administration. Informed consent was obtained from all participants before data collection.

Descriptive statistics such as mean and standard deviation were used to determine the levels of environmental attitudes and sustainability practices. Pearson r correlation coefficient analysis was employed to determine the relationship between environmental attitudes and sustainability practices of the students.

RESULTS

Level of Environmental Attitudes and Sustainability Practices among Students

Table 1 presents the level of environmental attitudes among students before and after taking STS 11 course. The results indicate an overall improvement in students' environmental attitudes, as reflected in the increase of the total mean score from 3.68 in the pre-assessment to 3.99 in the post-assessment. This finding implies that the course contributed positively to strengthening students' awareness, responsibility, and understanding of environmental issues. The increase in the post-assessment scores implies that students developed more favorable attitudes toward environmental protection and sustainability after exposure to the learning interventions incorporated in the subject.

Table 1. Level of Environmental Attitudes among Students.

Indicator	Pre-Assessment Mean (Std.Dev.)	Post-Assessment Mean (Std.Dev.)
Attitudes Related to Environmental Concern and Ecological Awareness	4.00 (0.89)	4.12 (0.86)
Personal Responsibility and Environmental Behavioral Commitment	3.64 (0.95)	3.96 (1.19)
Support for Environmental Governance, Policy, and Regulation	4.04 (0.89)	4.09 (0.83)
Environmental Knowledge, Education, and Technological Beliefs	3.04 (0.90)	3.80 (0.92)
Total	3.68 (0.91)	3.99 (0.95)

The overall environmental attitudes of students increased from 3.68 (High) before the intervention to 3.99 (High) after completing the STS 11 course, indicating that the course reinforced students' positive orientation toward environmental protection and sustainability. Rather than merely increasing awareness, the findings suggest that structured sustainability instruction facilitated cognitive and affective development by enabling students to critically examine the interrelationship between human activities and ecological systems. Although students already possessed favorable environmental attitudes prior to the course, the higher post-assessment mean indicates that the instructional experiences strengthened their environmental values and sense of ecological

responsibility. The result supports the premise of environmental education that sustained exposure to environmental concepts promotes gradual attitudinal change, which is a necessary precursor to long-term behavioral transformation.

Among the indicators, “attitudes related to environmental concern and ecological awareness” obtained a high mean score in both assessments, increasing from 4.00 in the pre-assessment to 4.12 in the post-assessment. This indicates that students already possessed a strong awareness of environmental issues before the course, and the subject further reinforced their concern for ecological preservation. Students who are more aware of environmental problems are more likely to develop positive environmental attitudes and support sustainable actions. Ardoin et al. (2018), emphasized that environmental education programs significantly improve students’ environmental awareness and ecological concern. However, the higher standard deviation of 1.19 in the post-assessment indicate greater variability in responses, while many students demonstrate strong personal commitment, others may experience difficulties translating environmental attitudes into consistent actions. According to Baierl et al. (2021), students may possess strong environmental concern yet still feel that their individual actions have limited environmental impact.

The relatively high pre-assessment mean indicates that students entered the course with substantial awareness of contemporary environmental issues, likely reflecting previous exposure through basic education, media, and public environmental campaigns. The modest increase to 4.12 shows that STS 11 course did not create awareness from the group up but instead deepened students’ understanding of environmental complexity and strengthened their concern for ecological preservation. This pattern illustrates a ceiling effect, where respondents already exhibit high baseline scores, leaving less room for substantial improvement. Nevertheless, reinforcing already positive attitudes remains educationally significant because sustained environmental concern is associated with continued engagement in pro-environmental decision-making.

The indicator “personal environmental responsibility and behavioral commitment” increased the mean from 3.64 in the pre-assessment to 3.96 in the post-assessment, showing noticeable improvement in the student’s sense of personal accountability toward environmental protection. The result implies that the course encouraged students to become more responsible in their daily environmental practices and decisions. The improvement implies that students became more willing to participate in sustainable activities and environmental conservation efforts after the course.

The increase from 3.64 to 3.96 represents one of the more meaningful improvements because this dimension reflects students perceived personal obligation to act rather than simply understand environmental issues. The findings show that the course encouraged students to shift from recognizing environmental problems to acknowledging their individual role in addressing them. This transition reflects movement from environmental awareness toward personal agency, an essential component of behavioral change theories, which emphasizes that personal attitudes influence behavioral intentions. The larger post-test standard deviation further indicates that although many students

strengthened their commitment, others remained hesitant, suggesting that translating environmental concern into personal responsibility varies depending on students' experiences, beliefs, and perceived ability to make meaningful environmental contributions.

The indicator "support for environmental governance, policy, and regulation" slightly increased from a mean of 4.04 in the pre-assessment to 4.09 in the post-assessment, indicating that students maintained strong support for environmental laws, policies, and institutional actions. This implies that students recognized the importance of government regulations and collective action in addressing environmental problems. Ardoin et al. (2020), showed that environmental education enhances students' understanding of environmental policies and promotes civic responsibility toward sustainability initiatives. Students exposed to environmental awareness campaigns and sustainability education are more likely to support environmental policies and regulations (Firmamshah et al., 2023).

The relatively small increase shows that attitudes toward environmental policies tend to be more stable than attitudes directly influenced by classroom learning. Unlike personal responsibility, which can readily develop through reflection and classroom activities, support for environmental governance is often shaped by broader social experiences, trust in institutions, and political awareness. The course served primarily to reinforce rather than substantially alter students' perceptions regarding environmental regulation.

The greatest improvement was observed in "environmental knowledge, education, and technological beliefs", which increased from a mean of 3.04 in the pre-assessment to 3.80 in the post-assessment. This substantial increase indicates that the STS 11 course effectively enhanced students' understanding of environmental concepts, the role of education, and the importance of technology in solving environmental issues. The result implies that students gained broader perspectives on how scientific knowledge and technological innovations contribute to environmental sustainability.

The largest improvement occurred in environmental knowledge and technological beliefs, indicating that this domain benefited most from the instructional intervention. Unlike environmental concern, which was already relatively high before the course, students initially possessed comparatively limited confidence in their understanding of environmental concepts and the role of science and technology in sustainability. The substantial increase demonstrates that STS 11 course successfully addressed knowledge gaps by providing scientific explanations, sustainability frameworks, and practical examples of technological solutions to environmental problems. This finding highlights that knowledge acquisition remains one of the strongest outcomes of formal environmental education because conceptual understanding is directly influenced by structured instruction.

The findings demonstrate that the STS 11 course positively influenced students' environmental attitudes across different dimensions. The increase in mean scores from the pre-assessment to the post-assessment implies that educational interventions, discussions, and sustainability-related activities

helped strengthen students' ecological awareness, personal responsibility, support for environmental governance, and environmental knowledge. Li et al. (2024) found that students who are exposed to structured environmental education demonstrate stronger environmental attitudes and greater environmental consciousness. Environmental attitudes are shaped by educational exposure, social influences, and personal experiences, all of which contribute to individual's willingness to support environmental protection.

Table 2 presents the level of sustainability practices among students among students before and after taking the course. The results reveal an overall improvement in students' sustainability practices, as reflected in the increase of the total mean score from 3.78 in the pre-assessment to 3.88 in the post-assessment. This finding implies that the STS 11 course contributed positively to enhancing students' sustainable behaviors and environmental practices. The increase in post-assessment scores indicates that students became more conscious and engaged in practices that support environmental sustainability after exposure to sustainability-related discussions and learning activities.

Table 2. Level of Sustainability among Students

Indicator	Pre-Assessment	Post-Assessment
Waste Reduction Practices	3.97 (0.90)	3.99 (0.94)
Energy and Water Conservation Practices	3.64 (1.00)	3.86 (1.04)
Sustainable Consumption Practices	3.78 (0.96)	3.89 (1.00)
Environmental Engagement and Advocacy	3.71 (1.06)	3.79 (1.09)
Total	3.78 (0.98)	3.88 (1.02)

The increase in the overall sustainability practices score from 3.78 to 3.88 indicates that students translated part of their improved environmental attitudes into actual behavioral practices. Although the increase was smaller than that observed for environmental attitudes, this pattern is consistent with environmental education research, which recognizes that behavioral change generally develops more gradually than cognitive or attitudinal change. While classroom instruction can readily influence knowledge and values within a semester, consistent behavioral habits often require repeated practice, supportive environments, and continued reinforcement beyond the classroom.

Among the indicators, "waste reduction practices" obtained the highest mean scores in both assessments, increasing slightly from 3.97 in the pre-assessment to 3.99 in the post-assessment. This result indicates that students already demonstrated positive practices related to minimizing waste even before taking the course, and these practices were maintained and slightly strengthened afterward. The findings imply that students were aware of the importance of

proper waste management, recycling, reusing materials, and reducing unnecessary consumption. Environmental education promotes responsible waste management behaviors and encourages students to adopt environmentally sustainable lifestyle through recycling and waste reduction activities (Ardoin et al., 2020; UNESCO, 2020)

This finding indicates a ceiling effect, where limited statistical improvement does not necessarily imply limited educational impact. Instead, the course likely reinforced existing habits and strengthened students' commitment to maintaining environmentally responsible waste practices.

The indicator "energy and water conservation practices" showed a noticeable increase from a mean of 3.64 in the pre-assessment to 3.86 in the post-assessment. This implies that students became more responsible in conserving natural resources, such as reducing electricity usage, saving water, and practicing energy-efficient behaviors. The improvement implies that the STS 11 course heightened students' awareness of the importance of resource conservation in addressing environmental challenges. According to Otto and Pensini (2017), environmental education enhances students' knowledge, attitudes, and conservation behaviors, leading to greater engagement in energy-saving and water conservation practices.

Conservation behaviors are often easier to implement because they involve simple daily actions such as turning off lights, conserving water, and minimizing electricity consumption. Students could readily apply concepts learned in class to their everyday routines, making this one of the most responsive behavioral domains.

The indicator "sustainable consumption practices increased from a mean of 3.78 in the pre-assessment to 3.89 in the post-assessment, indicating that students developed more responsible consumption habits after taking the STS 11 course. This includes choosing environmentally friendly products, reducing the use of single-use materials, and supporting sustainable alternatives. The result implies that students became more mindful of how consumer choices affect the environment. Studies on sustainable consumption explain environmental education can encourage individuals to make informed decisions that reduce environmental impact and promote sustainability (UNESCO, 2021).

Sustainable consumption may be constrained by practical considerations such as product variability, affordability, and family purchasing decisions. These students may have developed stronger intentions to consume sustainably, external socioeconomic factors may limit their ability to consistently translate these intentions into practice.

The indicator "environmental engagement and advocacy also improved from a mean of 3.71 in the pre-assessment to 3.79 in the post-assessment, showing that students became more involved in environmental activities, awareness campaigns, and advocacy efforts. Although the increase was moderate, the result still indicates positive development in students' participation in environmental initiatives and their willingness to encourage others to practice sustainability. According to Ardoin et al. (2020), environmental education programs foster civic engagement and encourage learners to participate in conservation actions and

community-based environmental initiatives. Effective environmental education enhances learners' motivation to engage in environmental action and influence others toward sustainable behaviors (Monroe et al., 2019).

Participation in environmental campaigns, volunteer work, and advocacy often requires opportunities, institutional support, and community involvement beyond classroom instruction. While the STS 11 course appears to have increased students' willingness to engage, sustained participation in environmental advocacy likely depends on continued extracurricular opportunities provided by the university and local communities.

The findings demonstrate that the STS 11 course positively influenced students' sustainability practices across different dimensions. The increase in mean scores from the pre-assessment to the post-assessment indicates that the educational interventions helped strengthen students' waste reduction behaviors, conservation practices, sustainable consumption habits, and environmental engagement. These findings implies that environmental education serves as an important tool in promoting sustainable lifestyles and encouraging students to become environmentally responsible individuals.

Relationship between Environmental Attitudes and Sustainability Practices

The relationship between environmental attitudes and sustainability practices were determined by utilizing Pearson r correlation coefficient. The obtained coefficient is **0.91**, which indicates a very strong positive relationship between environmental attitudes and sustainability practices. This means that respondents who exhibit higher levels of environmental attitudes increase, sustainability increase almost proportionally, and when sustainability practices increase, environmental attitudes also increase (Figure 2).

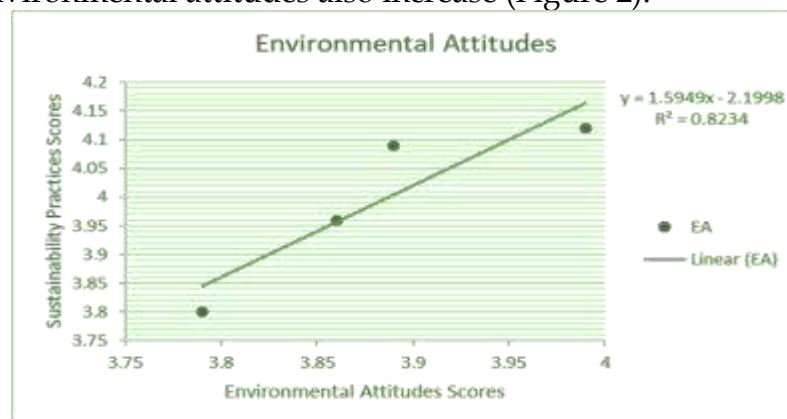


Figure 2. Correlation between Environmental Attitudes and Sustainability Practices

A Pearson correlation coefficient of 0.91, which shows an extraordinarily strong positive association, supports the regression findings. This demonstrates that people who are highly conscious of, concerned about, and committed to environmental issues are very likely to translate these ideas into practical,

sustainable actions like cutting back on waste, conserving energy, and participating in ecological activities. Similar substantial correlations between attitudes and sustainability compliance were found by Acido and Urbina (2025), which is consistent with the current findings. The scatter plot, which shows the consistency and intensity of the correlation by having data points closely packed around an upward-sloping regression line, supports this finding. Environmental views account for about 82.34% of the variation in sustainability actions, according to the statistical analysis. The high R^2 value of 0.82 and the significant correlation coefficient of 0.91 show that students with better environmental attitudes regularly exhibit more robust sustainability practices. The intervention or educational exposure given during the STS 11 – People and the Earth's Ecosystem course enhance the alignment between students' environmental ideals and their behavioral reactions, highlighting the efficacy of attitude-based approaches in promoting sustainability. While environmental attitudes are a major predictor of sustainable behavior, universities should complement attitude development with supportive campus policies, experiential learning opportunities, and institutional sustainability programs to maximize long-term behavioral change.

These results are consistent with the study of Kirby and Zwickle (2021), which showed that environmental beliefs have a major impact on university students' sustainability actions. In a similar vein, Liu et al. (2023) highlighted how students' attitudes and knowledge influence their behavioral intentions toward sustainability. The results of Baierl et al. (2022), which showed that pro-environmental activities and learning are supported by positive environmental viewpoints, are further supported by the observed association. Furthermore, Hadler et al. (2022) discovered that people's interactions with the environment and their propensity to embrace sustainable behaviors are influenced by their environmental attitudes.

DISCUSSION

The findings of the study demonstrate that environmental education through STS 11 – People and the Earth's Ecosystem course effectively enhances environmental awareness and ecological consciousness. Educational context in STS 11 course is reinforced by Tuazon et al. (2024) and Diaz et al. (2023), both emphasized that higher education is a crucial setting for cultivating sustainable behaviors. Students' strong support for environmental protection, sustainability-oriented policies, and environmental education aligns with the findings of Ardoin et al. (2018), who emphasized that environmental education strengthens environmental literacy and sustainable behavior. The high level of sustainability and practices observed among students indicates that environmental education contributes to practical behavioral outcomes. Waste reduction, recycling, and energy conservation practices appear to be widely adopted because they are visible, accessible, and reinforced through institutional and community initiatives. These findings support the work of Kirby and Zwickle (2021), who noted that students are more likely to engage in sustainability practices when environmental behaviors are practical and socially reinforced.

However, the study also identified gaps between environmental awareness and sustained behavioral commitment. Students reported lower confidence in the effectiveness of individual actions and demonstrated limited engagement in long-term environmental advocacy. This supports Baierl et al. (2021), who argued that awareness alone does not automatically results in behavioral change. Students may understand environmental problems but still encounter barriers such as lack of motivation, institutional support, or opportunities for active participation.

Students with stronger environmental beliefs and concerns are more likely to engage in pro-environmental behaviors, shown in the positive correlation between environmental attitudes and sustainability practices. This finding implies that strengthening environmental attitudes through education can positively influence sustainability practices among university students. Gorospe (2024) highlighted that positive attitudes toward environmental education are essential for effective integration of sustainability practices in school, even when challenges exist. The findings further imply that environmental education programs should move beyond theoretical discussions and incorporate experiential, participatory, and community-based learning approaches. Practical environmental activities, advocacy programs, and sustainability projects may help bridge the gap between awareness and action.

The results demonstrate that the STS 11 – People and the Earth’s Ecosystem course is a great teaching tool for raising students’ sustainability awareness, and environmental responsibility significantly increased after the course, even if their pre- and post- assessment attitudes were rather positive. The ability of STS 11 course to convert environmental knowledge into greater personal commitment and perceived behavioral control, two key factors in long-term sustainable behavior, is its most important contribution. However, the study discovered that real behavioral patterns improved more slowly than attitudes, especially in areas like transportation systems, consumption restrictions, and household-based sustainability initiatives that needed structural or outside support. The revealed that STS 11 course is effective in changing awareness and intentions, but additional reinforcement outside of the classroom may be required for long-term behavioral change. The STS 11 course has significant teaching value because it connects environmental theory to responsible, sustainable citizens in the real world. The STS 11 – People and the Earth’s Ecosystem course helps students become more ecologically resilient by enhancing sustainability behaviors, encouraging civic environmental participation, and improving environmental attitudes. Despite the gradual nature of transition, the learning process successfully provides the groundwork for long-term sustainability consciousness and responsible ecological citizenship.

CONCLUSIONS AND RECOMMENDATIONS

The study that students enrolled in the STS 11 – People and the Earth’s Ecosystem possess high levels of environmental attitudes and sustainability practices. Students demonstrate strong ecological awareness, concern for environmental protection, and support for sustainability initiatives. Similarly,

students engage in various sustainable behaviors, particularly in waste management, recycling, and energy conservation. The study also established a positive relationship between environmental attitudes and sustainability practices, indicating that strong pro-environmental attitudes contribute to greater engagement in sustainable behaviors. Environmental education therefore plays an important role in promoting environmental responsibility among university students.

However, the findings also revealed gaps in environmental self-efficacy, localized environmental awareness, and long-term environmental education strategies. Higher education institutions should strengthen environmental education programs by integrating experiential and community-based sustainability activities into the curriculum. Universities should also establish more environmental organizations, advocacy programs, and sustainability initiatives that encourage long-term student participation. Instructors should also employ more interactive and participatory teaching strategies and interventions such as fieldwork, environmental campaigns, community immersion, and sustainability projects to enhance students' environmental engagement and self-efficacy. Educational institutions should further emphasize localized environmental issues, including water pollution, waste management, and biodiversity conservation with local communities, to strengthen contextualized environmental awareness. Finally, policymakers and university administrations should provide institutional support and resources for environmental programs to sustain students' involvement in sustainability initiatives.

FURTHER STUDY

Future researchers are encouraged to conduct longitudinal studies to examine whether the improvements in students' environmental attitudes and sustainability practices are sustained beyond the duration of the course. Since the present study employed pre-assessment and post-assessment design within a single academic term, future investigations may assess participants over extended periods to determine the long-term effectiveness of environmental education interventions and the persistence of behavioral change.

Comparative studies involving multiple higher education institutions, geographic regions, and academic disciplines are also recommended to determine whether the findings are consistent across diverse educational contexts. Expanding the study population would improve the generalizability of the results and provide a broader understanding of how institutional characteristics and disciplinary backgrounds influence environmental attitudes and sustainability practices.

Future researchers may also investigate additional variables that were not examined in this study but may influence sustainable behavior, including environmental self-efficacy, environmental values, social norms, institutional culture, campus sustainability initiatives, environmental knowledge, socioeconomic status, and access to sustainability resources. Examining these variables may provide a more comprehensive explanation of the factors that

facilitate or hinder the adoption of sustainable behaviors among university students.

Qualitative studies focusing on students' lived experiences, perceptions, motivations, and challenges in practicing sustainability are likewise recommended. In-depth interviews, focus group discussions, and case studies may provide richer insights into how students interpret environmental education and the factors that either encourage or impede the translation of positive environmental attitudes into consistent sustainability practices.

Finally, future researchers may examine the effectiveness of specific instructional strategies implemented in environmental education courses, such as project-based learning, service-learning, community immersion, fieldwork, problem-based learning, and technology-enhanced sustainability education. Identifying which pedagogical approaches produce the greatest improvements in environmental attitudes and sustainability practices would provide valuable evidence for curriculum enhancement and the development of more effective sustainability education programs in higher education.

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REFERENCES

- Ácido, R. A. R., & Urbina, M. C. (2025). Knowledge, attitude and compliance with sustainability practices among managers of SMEs in Muscat, Oman. *International Journal of Academic Research in Business and Social Sciences*, 15(5). <https://doi.org/10.6007/IJARBS/v15-i5/25387> (doi.org in Bing)
- Antoro, B. (2024). Analisis penerapan formula Slovin dalam penelitian ilmiah: Kelebihan, kelemahan, dan kesalahan dalam perspektif statistik. *Jurnal Multidisiplin Sosial dan Humaniora*, 1(2), 53-63. <https://doi.org/10.70585/jmsh.v1i2.38>
- Ardoin, N. M., Bowers, A. W., Wyman Roth, N., & Holthuis, N. (2018). Environmental education and K-12 student outcomes: A review and analysis of research. *The Journal of Environmental Education*, 49(1), 1-17. <https://doi.org/10.1080/00958964.2017.1366155>
- Ardoin, N. M., Bowers, A. W., & Gaillard, E. (2020). Environmental education outcomes for conservation: A systematic review. *Biological Conservation*, 241, 108224. <https://doi.org/10.1016/j.biocon.2019.108224>
- Ardoin, N. M., Bowers, A. W., & Gaillard, E. (2023). Environmental education outcomes for conservation and sustainability: A systematic review. *Sustainability*, 15(4), 3251. <https://doi.org/10.3390/su15043251>

- Baierl, T. -M., Johnson, B., and Bogner, F. X. (2021). Assessing environmental attitudes and cognitive achievement within 9 years of informal earth education. *Sustainability* 13:3622. doi: 10.3390/su13073622
- Baierl, T.-M., Kaiser, F. G., and Bogner, F. X. (2022). The supportive role of environmental attitude for learning about environmental issues. *Journal of Environmental Psychology*. 81:101799. doi: 10.1016/j.jenvp.2022.101799
- Chen, C., Shahbaz, P., & Haq, S. U. (2025). Transforming students' green behavior through environmental education: The impact of institutional practices and policies. *Frontiers in Psychology*, 15. <https://doi.org/10.3389/fpsyg.2024.1499781>
- Díaz, M. T., Bajo-Sanjuan, A., Callejón Gil, Á. M., Rosales-Pérez, A., & López Marfil, L. (2023). Environmental behavior of university students. *International Journal of Sustainability in Higher Education*, 24(7), 1489–1506. <https://doi.org/10.1108/IJSHE-07-2022-0226>
- Firmanshah, M. I., Abdullah, N., & Fariduddin, M. N. (2023). The Relationship of School Students' Environmental Knowledge, Attitude, Behavior, and Awareness toward the Environment: A Systematic Review. *International Journal of Academic Research in Progressive Education and Development*, 12(1), Pages 471-488. <https://doi.org/10.6007/IJARPED/v12-i1/15707>
- Gorospe, J. R. C. (2024). Attitudes, challenges, and practices in integrating environmental education in the curriculum. *AIDE Interdisciplinary Research Journal*, 9, May 2024
- Hadler, M., Klösch, B., Schwarzingen, S., Schweighart, M., Wardana, R., & Bird, D. N. (2022). *Surveying Climate-Relevant Behavior: Measurements, Obstacles, and Implications*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-85796-7>
- Kirby, C.K., Zwickle, A. (2021). Sustainability behaviors, attitudes, and knowledge: comparing university students and the general public. *J Environ Stud Sci* 11, 639–647. <https://doi.org/10.1007/s13412-021-00717-x>
- Li, Y., Yang, D., & Liu, S. (2024). The impact of environmental education at Chinese Universities on college students' environmental attitudes. *PLOS ONE*, 19(2), e0299231. <https://doi.org/10.1371/journal.pone.0299231>
- Liu, Q., Tian, X., Bang, Y., & Park, K. H. (2023). Cognition and attitude toward sustainable development behavior: College students' informal online learning as a moderation effect. *Journal of Baltic Science Education*, 22(5), 900-913. <https://doi.org/10.33225/jbse/23.22.900>
- Lozano, R., Barreiro-Gen, M., & Zafar, A. (2023). Students' perceptions toward sustainability policies and environmental governance in higher education institutions. *International Journal of Sustainability in Higher Education*, 24(7), 1452–1470. <https://doi.org/10.1108/IJSHE-10-2022-0335>
- Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2019). Identifying effective climate change education strategies: A systematic review of the research. *Environmental Education Research*, 25(6), 791–812. <https://doi.org/10.1080/13504622.2017.1360842>
- Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are

- related to ecological behaviour. *Global Environmental Change*, 47, 88–94. <https://doi.org/10.1016/j.gloenvcha.2017.09.009>
- Sadiq, M. (2024). Embracing sustainability: Assessing the drivers of sustainable performance. *Migration Letters*, 21(S14), 70–98. <https://migrationletters.com/index.php/ml/article/view/11156>
- Tuazon, K. J. L., Moñedera, S. P., Corpuz, J. T., Mijares, A. M. I., Singh, R. C., Guillo, A. J., & De Guzman, S. D. (2024). Assessing the impact of environmental education on sustainable practices: A semi-systematic literature review. Cavite State University. Published November 25, 2024.
- UNESCO. (2020). Education for sustainable development: A roadmap. UNESCO Publishing. <https://unesdoc.unesco.org/>
- UNESCO. (2021). Education for sustainable development: A roadmap. UNESCO Publishing. <https://unesdoc.unesco.org/ark:/48223/pf0000374802>
- UNESCO. (2024). Education for sustainable development goals: Learning objectives and implementation strategies. UNESCO Publishing. <https://unesdoc.unesco.org>
- Zhang, J., & Cao, A. (2025). The psychological mechanisms of education for sustainable development: Environmental attitudes, self-efficacy, and social norms as mediators of pro-environmental behavior among university students. *Sustainability*, 17(3), 933. <https://doi.org/10.3390/su17030933>